

OFFICE OF NUCLEAR MATERIAL SAFETY AND SAFEGUARDS
DIVISION OF HIGH-LEVEL WASTE REPOSITORY SAFETY
TRIP REPORT

SUBJECT: STAFF EXCHANGE OF ALBERT WONG BETWEEN THE U. S. NUCLEAR REGULATORY COMMISSION AND THE CENTER FOR NUCLEAR WASTE REGULATORY ANALYSES

DATE: May 23 - 27, 2005

PLACE: San Antonio, Texas

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PERSONS

PRESENT: Albert Wong and Center for Nuclear Waste Regulatory Analyses staff

BACKGROUND

U. S. Department of Energy (DOE) is expected to submit its high-level waste (HLW) geological Repository License Application to U.S. Nuclear Regulatory Commission (NRC) in Fiscal Year (FY) 06. The Fuel Handling Facility (FHF) is projected to be the first major process building to be built at the proposed DOE HLW repository site to handle the spent fuel from around the country. In accordance with 10 CFR § 63.112, DOE must conduct a pre-closure safety analysis (PCSA) to ensure the pre-closure safety performance objectives stipulated in § 63.111 are fully met in the License Application. Accordingly, Center for Nuclear Waste Regulatory Commission (CNWRA) has developed a PCSA tool to perform pre-closure safety analyses. The information from the analyses are stored in a Microsoft Access database. The PCSA tool could aid the NRC and CNWRA staff in their review of a potential DOE HLW repository License Application.

PURPOSE OF TRIP

The purpose of this staff exchange was to enable the author to work closely with the CNWRA staff to exercise the PCSA tool. The exercise allowed the NRC/CNWRA staff to independently analyze the hazards of a hypothetical nuclear fuel facility using the PCSA tool. This hypothetical facility shares similar operational characteristics with the FHF. The results from the exercise would enhance staff's ability to use the PCSA tool during the review of DOE's proposed HLW repository License Application. The specific objectives met during the staff exchange included: (1) gaining familiarity with the different components within the PCSA tool; and (2) identifying the hazards and event scenarios in a hypothetical FHF.

SUMMARY OF KEY ACTIVITIES

- The staff collaborated with the CNWRA staff to identify hazards in the main transfer areas and fuel transfer area of the hypothetical FHF. A what-if analysis was conducted

Attachment

in a team environment to identify potential hazards and accident scenarios that could lead to waste releases. Examples of accident scenarios included waste package drops by the tilting machine and collisions of waste package trolleys with shield doors. The corresponding contributing causes (e.g., hardware v.s. human errors) and consequences were also identified. In addition, event scenarios for postulated accidents were developed using the Sapphire software. For example, the event scenario that could lead to material releases as a result of the primary ventilation system failure was analyzed extensively in the exercise. In addition, component/system failure data were fed into the event trees to estimate the system reliability. Failure data were obtained in two ways: (1) searching the literature for failure frequencies germane to the systems of interest; and (2) constructing fault trees (using Sapphire) and calculating the failure rates accordingly. Again, the primary ventilation system was used as an example in the fault tree analysis. Suggestions on how to improve the PCSA tool were discussed with the CNWRA staff during the exercise.

- The staff also witnessed demonstration runs on other modules (e.g., the consequence module) in the PCSA tool that was not studied in detail due to time constraints. The demonstration runs were carried out by the CNWRA's subject matter expert (SME). Primarily the demonstration centered on the source terms calculations using the MELCORE code and the dose calculations using the RSAC code. Similar to the Sapphire software, the RSAC is linked to the PCSA tool and can be invoked from within the tool.
- The staff discussed the MECHFAIL model developed by the CNWRA with the cognizant SME. MECHFAIL is used in the Total System Performance Assessment (TSPA) code to predict the drip shield behavior in future rock fall/seismic conditions and model the drip shields' interactions with the waste packages under those conditions. The discussion focused on: (1) key assumptions in the model and how they compared to the DOE's mechanical degradation model; and (2) future direction for the model development.

PROBLEMS ENCOUNTERED

None

PENDING ACTIONS

The PCSA exercise will continue for the rest of FY05. The hypothetical FHF exercise is scheduled to be concluded by the end of FY05.

ACCOMPLISHMENTS

- The participants gained hands-on experience in working with the PCSA tool as well as the hazards, processes and accident event scenarios of a hypothetical fuel handling facility. This knowledge will be useful in future interactions with DOE.
- The participants became more familiar with the MECHFAIL module in the TSPA code. This knowledge will enhance the safety reviews in the post-closure areas.
- Working with the CNWRA staff closely on a daily-basis led to greater mutual understanding between team members. The collegiality was conducive to building a

stronger and more cohesive review team, which should bode well in any upcoming review of a potential HLW repository License Application from DOE.

RECOMMENDATIONS

Staff participation in future staff exchanges between the NRC and the CNWRA is greatly encouraged and continue as part of the ongoing program activities. Continuing analysis of pre-closure facilities should proceed to better prepare the staff for a potential License Application from DOE.